

**REMARKS**

Claims 1 and 4 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Applicants admitted prior art in view of U.S. Patent 4,358,663 to Sperner et al, further in view of U.S. Patent 4,582,980 to Izzi.

Sperner et al was cited as teaching a heating coil coated with a platinum group metal or alloy thereof so as to impart chemical stability and good fabrication qualities. Izzi was cited as teaching a glow plug having a heating coil made of a Fe-Cr-Al alloy. The reason for rejection was that it would have been obvious to provide a heater coil of the admitted prior art (said to teach the claimed structure except for the coating layer) with a platinum coating as taught by Sperner et al to prolong heater life, and to further use a Fe-Cr-Al alloy heater coil as taught by Izzi, to ensure rapid heat-up and improved heating control obtained by the use of such a high-resistance alloy with low temperature coefficient.

Applicants traverse, and respectfully request the Examiner to reconsider for the following reasons.

As claimed in claim 1, the present invention is directed to a glow plug including a sheathed heater including a heating coil portion and an insulating MgO powder charged in the sheath. The heating coil portion comprises a coil base material and a coating layer. The coil base material comprises a Fe-Cr-Al alloy, and the coating layer is selected from a metal or metal alloy of Pt, Pd, Rh and an alloy of two or more of Pt, Pd and Rh. The present invention solves the problem of the reaction of the insulating MgO powder with Fe or Ni contained in an alloy used to form the heating coil portion. This is achieved by coating the coil base material with a noble metal or alloy thereof as claimed in claim 1, to prevent direct contact between the MgO

and the coil base material. Particularly, the present invention provides a glow plug that exhibits practically sufficient durability even at a high temperature in excess of 1,000°C. See paragraph [11].

The Examiner's position on obviousness at page 3 of the Office Action is reproduced below:

**In view of Sperner et al (U.S. 4,358,663), it would have been obvious to one of ordinary skill in the art to provide a heater coil with a platinum coating in lieu of the uncoated heater wire of admitted prior art glow plug to increase the heater wires chemical stability at elevated temperatures, thereby prolonging heater life.**

In the "discussion of prior art" at col. 1, Sperner et al describes conventional glow plugs in which the heater coil is embedded by means of an insulating magnesium oxide powder in a heater tube made of a heat-resistant steel (col. 1, lines 21-23). However, using such a configuration, preheating times of up to two minutes have been observed in practice in colder weather using this configuration and structure (col. 1, lines 29-32). Sperner et al seeks to solve the above-noted problem of the prior art by providing a protective tube including openings over its circumference which are of such number and size that sufficient fuel and air are able to pass to the heater coil to form a combustible mixture (col. 2, lines 54-58). The heater coil is formed of a material having a high specific electrical resistance, such as molybdenum or tungsten (col. 3, lines 39-41) and the core metal is coated with a Pt group metal or ally thereof (col. 2, line 65 - col. 3, line 16), presumably to provide good chemical stability at high temperature to the fuel or fuel-air mixture in contact with the heater coil (col. 4, lines 53-57).

The "admitted prior art" describes a glow plug including heating coil portion 30b made of a Fe-Cr or Ni-Cr alloy embedded in MgO powder 3d.

Sperner et al provides the Pt group metal or alloy coating in order to protect the core metal from the high temperature fuel or fuel-air mixture to which it is exposed, but not to MgO powder embedding the heater coil. In fact, Sperner et al discusses such an embedded heater coil in his "Discussion of Prior Art" but rejects this approach as resulting in too long of a preheating time. A heater coil such as that in Sperner et al exposed to high temperature fuel or fuel-air mixture is fundamentally different from a heater coil embedded in MgO, even if operated at the same temperature. The fact that Sperner et al teaches application of a Pt group metal or alloy coating to the heater coil that is exposed to high temperature fuel or fuel-air mixture says nothing about the need, advantage or desirability of coating a heater coil embedded in MgO powder.

Moreover, none of the prior art cited by the Examiner teaches the problem solved by the present invention (i.e., at a high temperature in excess of 1,000°C, the insulating MgO powder reacts with Fe or Ni contained in the heater coil alloy resulting in breakage), and it is discovery of the source of the problem which is unobvious over the prior art (even though the remedy may be obvious once the source of the problem is identified).

For example, in *In re Peehs*, 204 USPQ 835 (CCPA 1980), neither the problem nor the source of the problem were known in the art:

**A patentable invention may lie in the discovery of the source of a problem even though the remedy may be obvious once the source of the problem is identified. This is *part* of the "subject matter as a whole" which should always be considered in determining the obviousness of an invention under 35 U.S.C. § 103.**

Particularly, where the advance in the art lies in the discovery of the problem or the source of the problem, to support a rejection the Examiner must provide evidence that a person of ordinary skill would have expected a problem to exist. However, this is not the case here.

From a different perspective, Sperner et al is directed to an “exposed” heater coil. If such coil should be embedded in MgO powder in a pin type heater plug, identified as prior art in Sperner et al, the intended function would be destroyed. That is, as shown above, Sperner et al seeks to provide a heater plug in which the heater coil is not embedded in MgO to solve yet other problems of conventional glow plugs. See MPEP § 2143.01-THE PROPOSED MODIFICATION CANNOT RENDER THE PRIOR ART UNSATISFACTORY FOR ITS INTENDED PURPOSE.

In view of the above, Sperner et al does not teach or suggest a coating for a heating coil embedded in MgO, and furthermore teaches away from embedding the coil disclosed therein in MgO powder.

Izzi discloses no more than a Ni coating on a Fe-Cr-Al wire, in addition to an uncoated Ni-Cr-Al wire embedded in MgO powder. That is, Izzi does not teach or suggest a Pt, Pd or Rh coating (or an alloy of two or more thereof) for the heating element L2 as well as for the control element L1.

In summary, the main premise of the rejection is that would have been obvious to provide a heater coil with a platinum coating in place of the uncoated heater wire of the admitted prior art glow plug to increase stability and prolonged heater life. The rejection is made in view of Sperner et al, but fails to take into account the environment of the claimed glow plug, namely, one in which the heating coil is embedded in MgO powder.

Sperner et al seeks to solve the problems occurring in conventional glow plugs in which the heater coil is embedded in MgO by providing a protective tube including openings which

allow fuel and air to pass to the heater coil to form a combustible mixture. That is, not only would the suggested combination destroy the intended function of Sperner et al (the function being to avoid the use of MgO powder), but Spencer et al also teaches against the very structure that the Examiner ascribes to this prior art. Also as mentioned above, Izzi teaches nothing more than a Ni-coated or uncoated Ni-Cr-Al wire which says nothing about a Pt, Pd or Rh coating.

For the above reasons, it is respectfully submitted that claims 1 and 4 are patentable over Applicants' admitted prior art in view of Sperner et al, further in view of Izzi, and withdrawal of the foregoing rejection under 35 U.S.C. § 103(a) is respectfully requested.

Claim 3 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Applicants' admitted prior art in view of Sperner et al, Izzi and further in view of JP 2001-153359 (JP '359). The Examiner relied on JP '359 as teaching a Pt coating layer thickness of a heating coil of a glow plug having a thickness of from 0.5-10  $\mu\text{m}$  so as to avoid peeling while also minimizing expense. The reason for rejection was that it would have been obvious to coat the wire core with a Pt coating having a thickness within the claimed range (overlap at 0.5  $\mu\text{m}$ ) so as to prevent peeling or oxidation, yet minimizing the amount of platinum that is needed.

Applicants respectfully traverse for the following reasons.

Present claim 3 specifies a rather thin Pt layer. This is because a Pt layer that is too thick would adversely affect the property of the core material selected for the heating element.

To the contrary, Sperner et al requires a rather thick Pt layer of 5-50  $\mu\text{m}$ , ten times as thick as that of the invention. See column 3, lines 35-36. Izzi is silent as to the thickness of the Ni layer. Presumably, a sufficiently thick Ni layer is needed to modify into a control element.

JP '359 discloses not only a Pt plating on a Fe wire, but also an uncoated Ni-Cr wire embedded in MgO. That is, JP '359 does not teach or suggest a coating for a coil base material comprising a Fe-Cr-Al alloy, let alone a thickness of 0.2  $\mu\text{m}$  to 0.5  $\mu\text{m}$  as claimed.

That is, the rejection takes a Pt coating of JP '359 which does not teach a coil base material comprising a Fe-Cr-Al alloy as claimed, and combines with Sperner et al which teaches away from embedding the coil in MgO. Spencer et al also does not teach a coil base material comprising a Fe-Cr-Al alloy, and moreover teaches a Pt coating thickness ten fold or more greater than that what is claimed in present claim 3. In order to complete the rejection, the Examiner must rely on Izzi with respect to the material of the coil base, while acknowledging that Izzi does not teach a Pt coating whatsoever. Once the invention of claim 3 is looked at as a whole in comparison to the prior art, it is respectfully submitted that the suggested combination and modifications just do not hold together.

For the above reasons, it is respectfully submitted that claim 3 is separately patentable over the applied prior art, and withdrawal of the foregoing rejection under 35 U.S.C. § 103(a) is respectfully requested.

Withdrawal of all rejections and allowance of claims 1, 3 and 4 is earnestly solicited.

In the event that the Examiner believes that it may be helpful to advance the prosecution of this application, the Examiner is invited to contact the undersigned at the local Washington, D.C. telephone number indicated below.

RESPONSE UNDER 37 C.F.R. § 1.116  
U.S. Application No. 10/786,395 . . . .

Q80012

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Respectfully submitted,



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